

CLAIMS

What is claimed is:

1. (Amended) Crosslinked microparticles of between 10 and 300 nm in size, obtained by polymerization of a composition of ethylenically unsaturated polymerizable compounds, ~~characterized in that the composition of the polymerizable compounds comprises~~ comprising:

- a first component A representing from 50 to 99 mol% of the ~~said~~ composition and selected from the group consisting of isobornyl (meth)acrylate ~~and/or,~~ norbornyl (meth)acrylate ~~and/or,~~ cyclohexyl (meth)acrylate ~~and/or,~~ Cardura E10 (meth)acrylate and combinations thereof, optionally in combination with a C₂-C₈ alkyl (meth)acrylate

- a second component B consisting of at least one monomer or oligomer comprising at least two ethylenic unsaturations which can undergo radical-mediated polymerization, the ~~said~~ monomer or oligomer being other than an allylic(meth)acrylate

- a third component C consisting of at least one monomer or oligomer comprising, in addition to an ethylenic unsaturation which can undergo radical-mediated polymerization, at least one ~~second~~ reactive function f₁ which is different from the ethylenic unsaturation

optionally ~~with the possibility of~~ at least partial chemical modification of the initial functions f₁ into final functions f₂ under the condition that the functions f₁ selected do not react with each other during the polymerization, with the sum of the components A, B and C being 100 mol%. ~~%.~~

~~2. Microparticles according to Claim 1, characterized in that they bear~~ 2. (Amended) The microparticles of Claim 1, wherein functions f₁ borne by the component C, ~~which~~ are selected from the group consisting of: epoxy, hydroxyl, carboxyl, carboxylic anhydride, isocyanate, silane, amine, oxazoline, and, where appropriate, functions f₁ at least partially modified into functions f₂, selected from: (meth)acrylates, vinyls, maleates, maleimides, itaconates, allylic alcohol esters,

unsaturations based on dicyclopentadiene, C₁₂-C₂₂ unsaturated fatty esters or amides, carboxylic acid salts ~~or~~ and quaternary ammonium salts.

3. ~~Microparticles according to either of Claims 1 and 2, characterized in that the~~(Amended)

The microparticles of Claim 1 wherein component C is present in a molar content of between 0 and 49.5 mol% relative to the sum of the polymerizable compounds, and is selected from the group consisting of: glycidyl (meth)acrylate, C₂-C₆ hydroxyalkyl (meth)acrylates, (meth)acrylic acid, maleic acid or anhydride or fumaric acid, itaconic acid or anhydride, isocyanatoethyl (meth)acrylate, dimethylaminoethyl (meth)acrylate, and 2-(5-methacryloyl-pentyl) -1,3-oxazoline.

4. ~~Microparticles according to one of Claims 1 to 3, characterized in that the~~(Amended) The microparticles of Claim 1 wherein component B is selected from multifunctional (meth)acrylate monomers of functionality ranging from 2 to 6, substituted or unsubstituted divinylbenzenes and/or multifunctional (meth)acrylic ester oligomers or unsaturated polyesters of functionality ranging from 2 to 50 and with an a number average molecular weight Mn of less than 2500.

5. ~~Microparticles according to one of Claims 1 to 4, characterized in that~~(Amended) The microparticles of Claim 1 wherein the composition of the polymerizable compounds comprises:

- 50 to 95 % mol% of a component A selected from the group consisting of isobornyl (meth)acrylate ~~and/or~~₂ norbornyl (meth)acrylate ~~and/or~~₂ butyl (meth)acrylate and combinations thereof

- 0.5 to 10 % mol% of a component B consisting of at least one monomer and/or oligomer selected from:

- di(meth)acrylates of: ethylene glycol, propylene glycol, butanediol, 2-methylpropanediol, neopentyl glycol, hexanediol, diol oligomers with an Mn of less than 2500, preferably polyethers, polyesters or polyurethanes

- substituted or unsubstituted divinylbenzenes

- unsaturated polyester oligomers or acrylated acrylic oligomers with an Mn of less than 2500

and having a number of ethylenic unsaturations per mole of from 2 to 50

- not more than 49.5 mol% of a component C consisting of at least one monomer and/or oligomer selected from:

- (meth)acrylic acid, maleic, fumaric or itaconic acid, when f1 is a carboxyl function;

- maleic anhydride or itaconic anhydride when, f1 is a carboxylic anhydride function;

- hydroxyalkyl (meth)acrylates containing a C₂C₆ alkyl or mono (meth) acrylates of polyether or polyester or polyurethanediol or polycaprolactone oligomers with ~~and~~ an Mn of less than 1500, when f1 is a hydroxyl function;

- glycidyl (meth)acrylate, (meth)acrylates of epoxidized derivatives of dicyclopentadiene or epoxidized vinylbornene (meth)acrylates or alkoxyated glycidyl ether (meth)acrylates or (meth)acrylates of epoxidized derivatives of cyclohexene, when f1 is an epoxy ~~function~~ function;

- isocyanatoethyl (meth)acrylate and urethane mono (meth) acrylates derived from diisocyanates, when f1 is an isocyanate function;

- (meth)acrylates bearing a trialkyl or trialkoxysilane group, when f1 is a silane function;

- dimethylaminoethyl (meth)acrylate or tert-butylaminoethyl (meth)acrylate, when f1 is an amine function;

- 2-(5-(meth)acryloylpentyl)-1, 3-oxazoline, when f1 is a oxazoline function;

with the sum A + B + C being equal to 100 mol%, %.

~~6. Microparticles according to one of Claims 1 to 5, characterized in that they bear carboxyl functions f1 or carboxyl functions f1~~ 6. (Amended) The microparticles according to Claim 1 wherein f1 is carboxyl functions or hydroxyl functions which are partially or totally modified into functions f2 selected from the group

7. ~~Microparticles according to one of Claims 1 to 6, characterized in that they bear hydroxyl functions f1 or epoxy functions which are partially~~ 7. (Amended)

The microparticles of Claim 1 wherein they bear hydroxyl or epoxy functions f1 possibly partially modified into (meth)acrylate functions f2.

8. ~~Process~~ (Amended) A process for preparing the microparticles as defined in ~~one of Claims 1 to 7~~, characterized in that it comprises a step of Claim 1, the process comprising the steps of:

= polymerizing, via radical-mediated dispersion polymerization, in a non-aqueous medium which is a nonsolvent for the polymer formed, ~~of a composition of polymerizable compounds as defined in one of Claims 1 to 5~~ Claim 1, without any addition of a stabilizing polymer for the microparticles formed, either before, during or after polymerization, ~~it being possible for the said process to comprise, where appropriate, an additional step of at least partial chemical modification of~~ and optionally,

= chemically modifying, at least partially, the functions f1 borne by the component C as defined in ~~one of Claims 1 to 3 and 5.~~

9. ~~Coating or~~ 9. (Amended) A coating, moulding or composite composition, characterized in that it comprises microparticles as defined in ~~one of Claims 1 to 7~~, comprising the microparticles of Claim 1.

10. ~~Composition according to Claim 9, characterized in that it is crosslinkable and consists solely or essentially of microparticles as defined in one of Claims 1 to 7,~~

10. (Amended) The composition of Claim 9 consisting essentially of the microparticles of Claim 1 comprising functions f1 and/or f2 which are identical or different and which can be crosslinked between microparticles, forming at least one crosslinking network.

11. ~~Composition according to Claim 9, characterized in that it comprises~~ (Amended) The composition of Claim 9 comprising from 0.5 to 50%

multifunctional monomers and/or multifunctional acrylic oligomers and microparticles defined according to one of Claims 1 to 7, bearing (meth)acrylate and/or maleate and/or fumarate and/or (ii) the microparticles of Claim 1 bearing f2 functions selected from the group consisting of (meth)acrylate, maleate, fumarate, maleimide functions f2 and combinations thereof, the f2 functions obtained from the at least partial modification of the starting functions f1.

14. ~~Composition according to Claim 12 or 13, characterized in that~~(Amended)

The composition of Claim 12 wherein the coating composition is a composition which can undergo crosslinking by radiation.

15. ~~Composition according to Claim 13 or 14, characterized in that~~(Amended)

The composition of Claim 13 wherein the crosslinkable composition comprises, as: (i) acrylic monomers, selected from the group consisting of: isobornyl (meth)acrylate and/or, isodecyl (meth)acrylate, lauryl (meth)acrylate, 2-(2-ethoxyethoxy) ethoxyethoxy ethyl (meth)acrylate, tridecyl (meth)acrylate, 2-phenoxyethyl (meth)acrylate, tetrahydrofurfuryl (meth)acrylate, and/or, ~~as acrylic oligomers, and combinations thereof, and/or (ii)~~ at least one acrylic oligomer chosen from the group consisting of: polyether (meth)acrylates, polyester (meth)acrylates, polyurethane (meth)acrylates, polycaprolactone (meth)acrylates, epoxy (meth)acrylates and (meth) acrylated acrylic copolymers.

16. ~~Coating~~(Amended) The coating composition as ~~defined in one of Claims 12 to 14 of Claim 12,~~ characterized in that it is intended to be applied or is applied in the form of a coating on polar or non-polar substrates and comprises:

0.5 to 50% and preferably from 5 to 30% by weight of ~~microparticles as defined the microparticles of in one of Claims 1 to 7, bearing (meth)acrylate and/or maleate and/or fumarate and/or maleimide functions f2~~ Claim 1, having f2 functions selected from the group consisting of: (meth)acrylate, maleate, fumarate, maleimide and combinations thereof,

- [illegible]

17. Coating(Amended) The coating composition according to Claim 16, characterized in that wherein:

the polar substrates are selected from the group consisting of: glass, steel, aluminum, silicon, polycarbonate, wood, glass fibres, carbon fibres, cellulose fibres, polyester or polyamide fibres;

- the non-polar substrates are selected from the group consisting of: polyolefins and more particularly polyethylene, polypropylene and ethylene/propylene copolymers with or without special surface treatment, and coatings of low surface tension.

18. ~~Coating composition according to Claims 16 or 17, characterized in that it is~~(Amended) The coating composition of Claim 16 applied to the substrate in the form of a thin film with a thickness of less than 100 microns, preferably less than 50 microns.

19. ~~Composition according to Claim 12, characterized in that the said 19.~~(Amended) The composition of Claim 12, wherein the coating composition is a composition of an aqueous dispersion of a crosslinkable polymer, comprising reactive water-dispersible or water-soluble microparticles,

which participate in the crosslinking.

20. (Amended) The coating composition of Claim 9, wherein the Coating composition according to one of Claims 9 to 12, characterized in that the said composition is a composition comprising epoxidized derivatives.

21. (Amended) The coating composition of Claim 20, wherein the composition is crosslinkable ~~Coating composition according to Claim 20, characterized in that it can undergo crosslinking~~ by UV radiation in the presence of a cationic photo-initiator and comprises microparticles bearing epoxy and/or hydroxyl functions fl.

22. ~~Coating composition according to Claim 20, characterized in that it can undergo crosslinking~~(Amended) The coating composition of Claim 20,

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crosslinked by condensation reaction, it ~~comprises~~ the composition comprising
microparticles ~~bearing epoxy and/or hydroxyl and/or carboxyl and/or anhydride~~
having functions f1 and/or f2 selected from the group consisting of: epoxy;
hydroxyl; carboxyl; anhydride; and combinations thereof.

24. (Amended) The coating composition of Claim 9, wherein the
composition comprises: (i)-

~~24. Coating composition according to one of Claims 9 to 12, characterized in that~~
~~this composition comprises- at least one reactive resin selected from the group~~
~~consisting of: alkyds or, unsaturated polyesters or, saturated polyesters or~~
~~polyamides or polyurethanes or polyureas and microparticles as defined in one of~~
~~Claims 1 to 7, preferably comprising functions f1 and/or f2 that are reactive with~~
~~at least one function borne by this or these reactive resin (s)-, polyamides,~~
polyurethanes and polyureas and (ii) the microparticles of Claim 1.

~~25. Moulding composition according to Claims 9 to 11, characterized in that it~~
~~comprises~~ 25. (Amended) The moulding composition of Claim 9 further
comprising: (i) at least one reactive resin selected from the group consisting of:
unsaturated polyesters, dicyclopentadiene resins, vinyl esters, epoxides and
polyamines or polyurethanes and polyureas or polyurethane ureas and
microparticles as defined in one of Claims 1 to 7, preferably comprising functions
f1 and/or f2 that are reactive with at least one function borne by this or these

reactive resin(s), polyamines, polyurethanes, polyureas and polyurethane-ureas;
and (ii) the microparticles of Claim 1.

26. Moulding 26. (Amended) The moulding composition according to
Claim 25, characterized in that it comprises further comprising inorganic and/or
organic fillers and/or reinforcing agents chosen from the group consisting of:
glass fibres, glass mats, carbon fibres, cellulose fibres, polyester or polyamide
fibres. and polyamide fibres.

27. (new) The coating composition of Claim 24 wherein the microparticles
further comprise functions f1 and/or f2 that are reactive with at least one function
borne by this or these reactive resin (s).

28. (new) The moulding composition of Claim 25 wherein the microparticles
further comprise functions f1 and/or f2 that are reactive with at least one function
borne by this or these reactive resin (s).